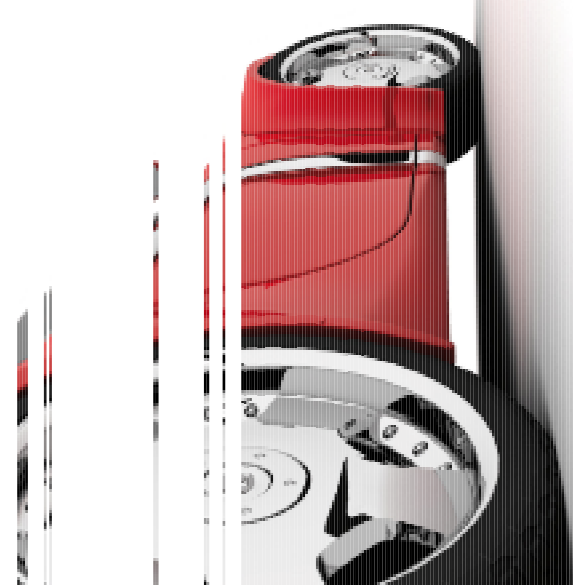


# FILTRATION BY TEXTILE MEDIA DORN BIRN

Philippe PINEAU Mecaplast Lens



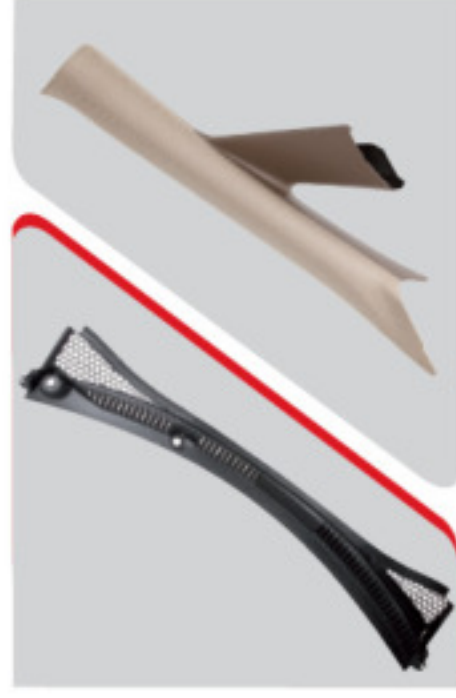
## 1 – MECAPLAST Group overview

- **Production:** 26 production sites in 15 countries
- **Development:** 3 technical centers

Mecaplast Group is one of the european leaders in auto parts, specialized in plastic injection.

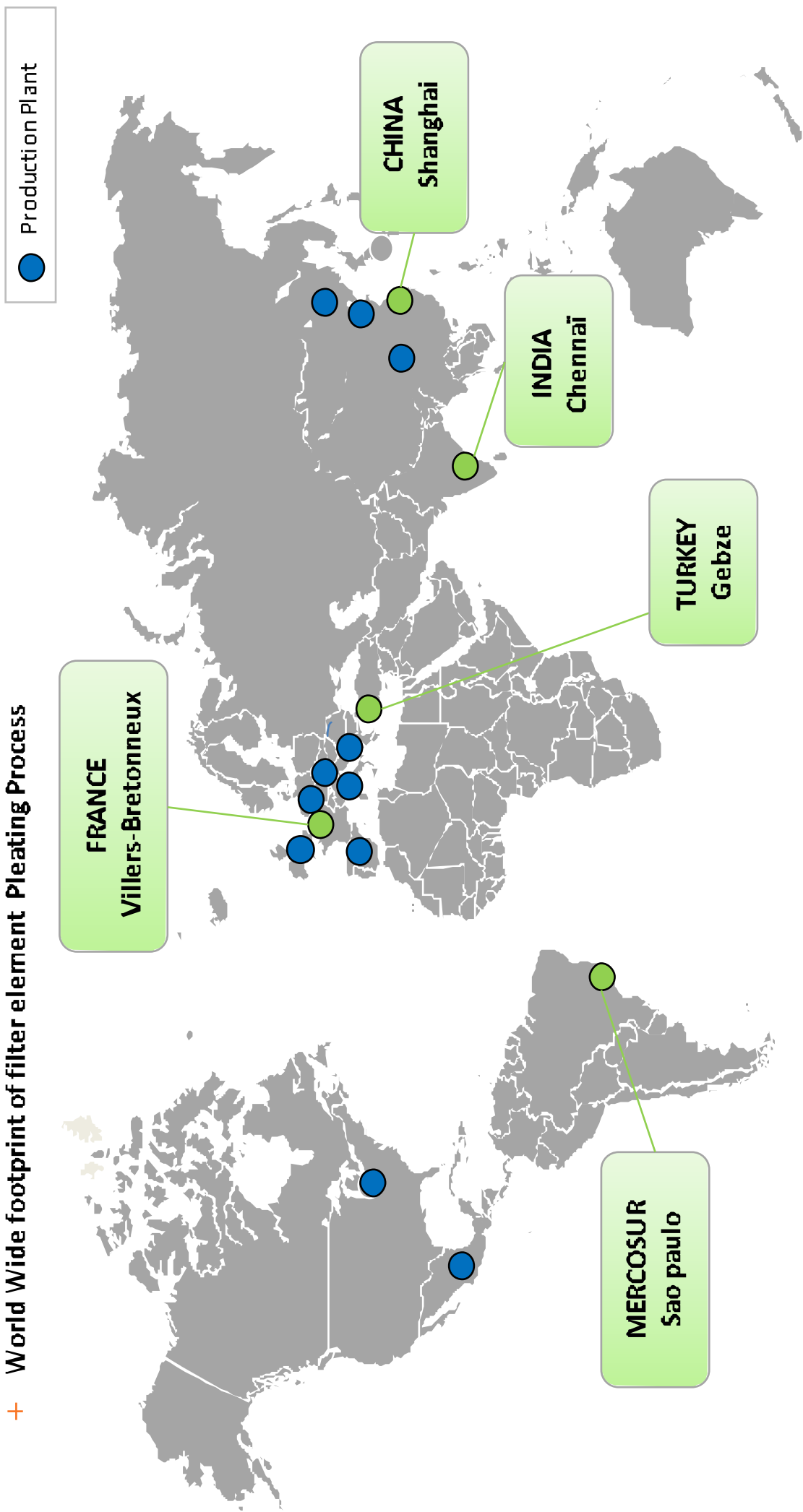
Founded in 1955 by Charles Manni, the Group designs, develops and manufactures parts and complete systems for vehicle Body and Engine. Today it reports a revenue of 661 million euros.

Our 6000 employees are based in 16 countries to serve automotive markets across the world.



IN HOUSE ENGINEERING AND PRODUCTION

+ World Wide footprint of filter element Pleating Process



IN 2010, LESS THAN 5 P.P.M. ALL OVER THE WORLD

# ENGINE PRODUCT LINE

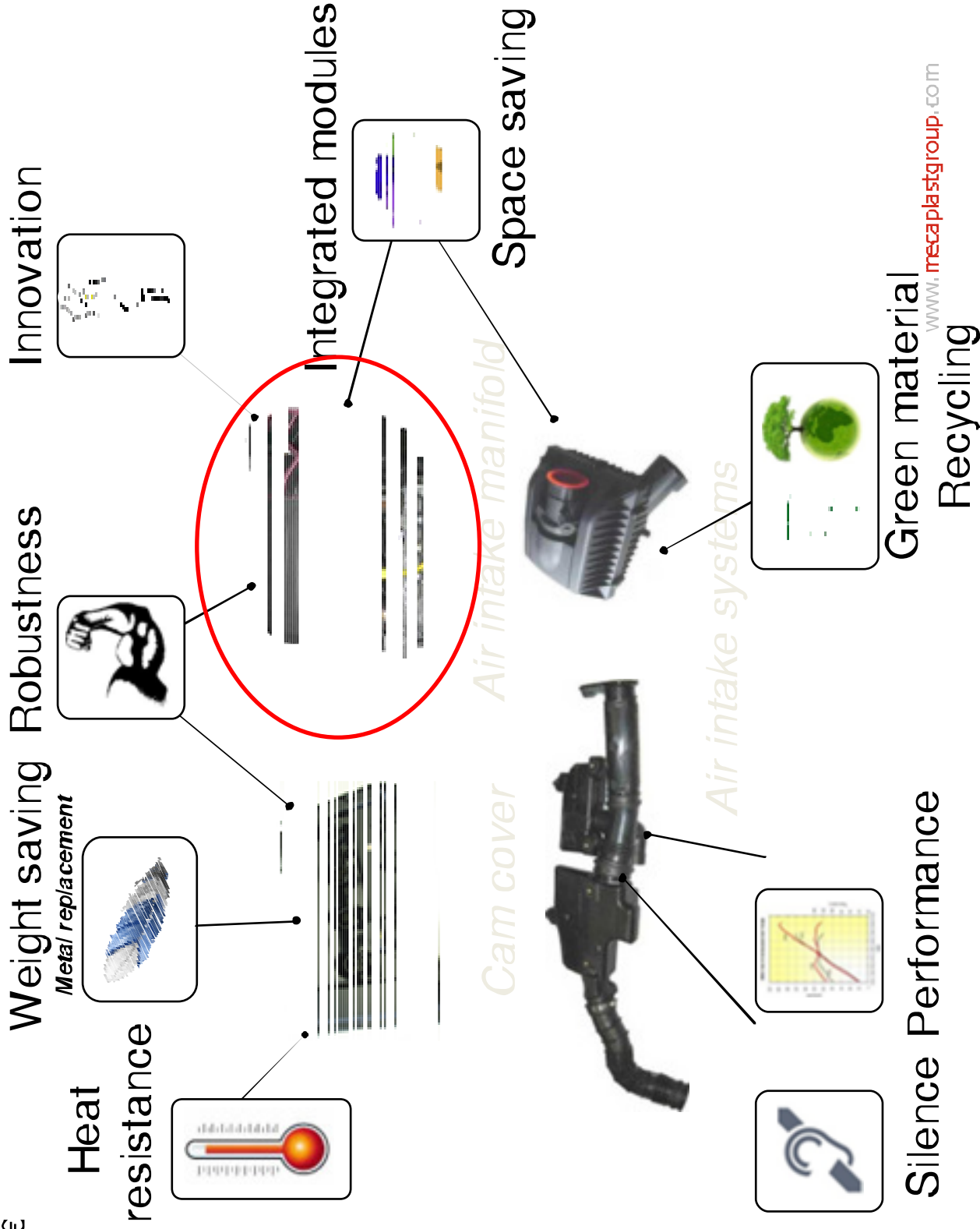
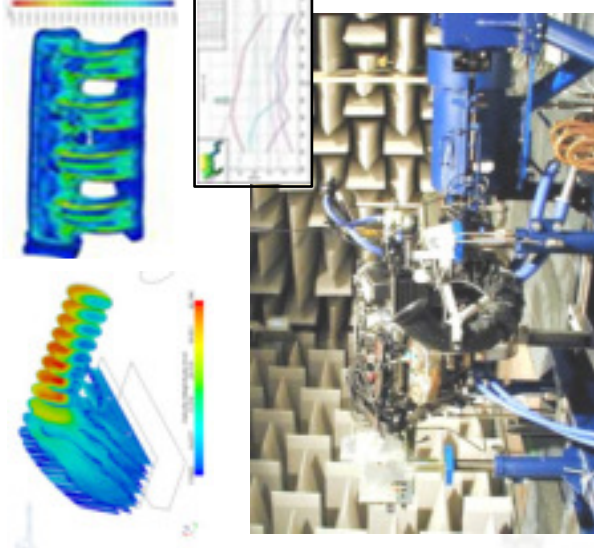
CONFIDENTIEL

## LENS technical centre

- Starting date 1992
- Workforce 148
- Turnover 2011 = 248 M€

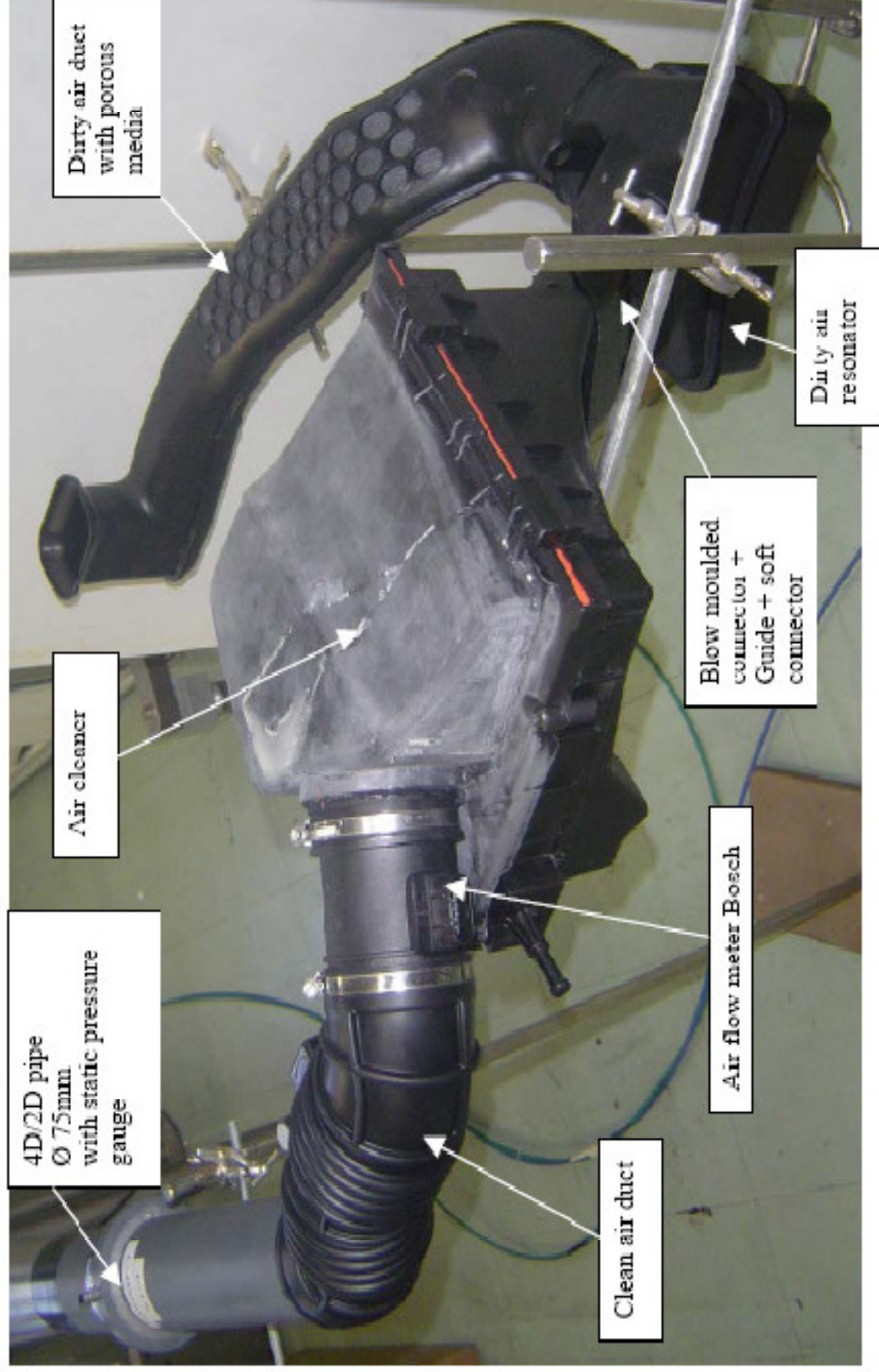
## Leader and innovative in engine systems since 1987

*Master builder from designing to manufacturing*



# AIR INTAKE LINE

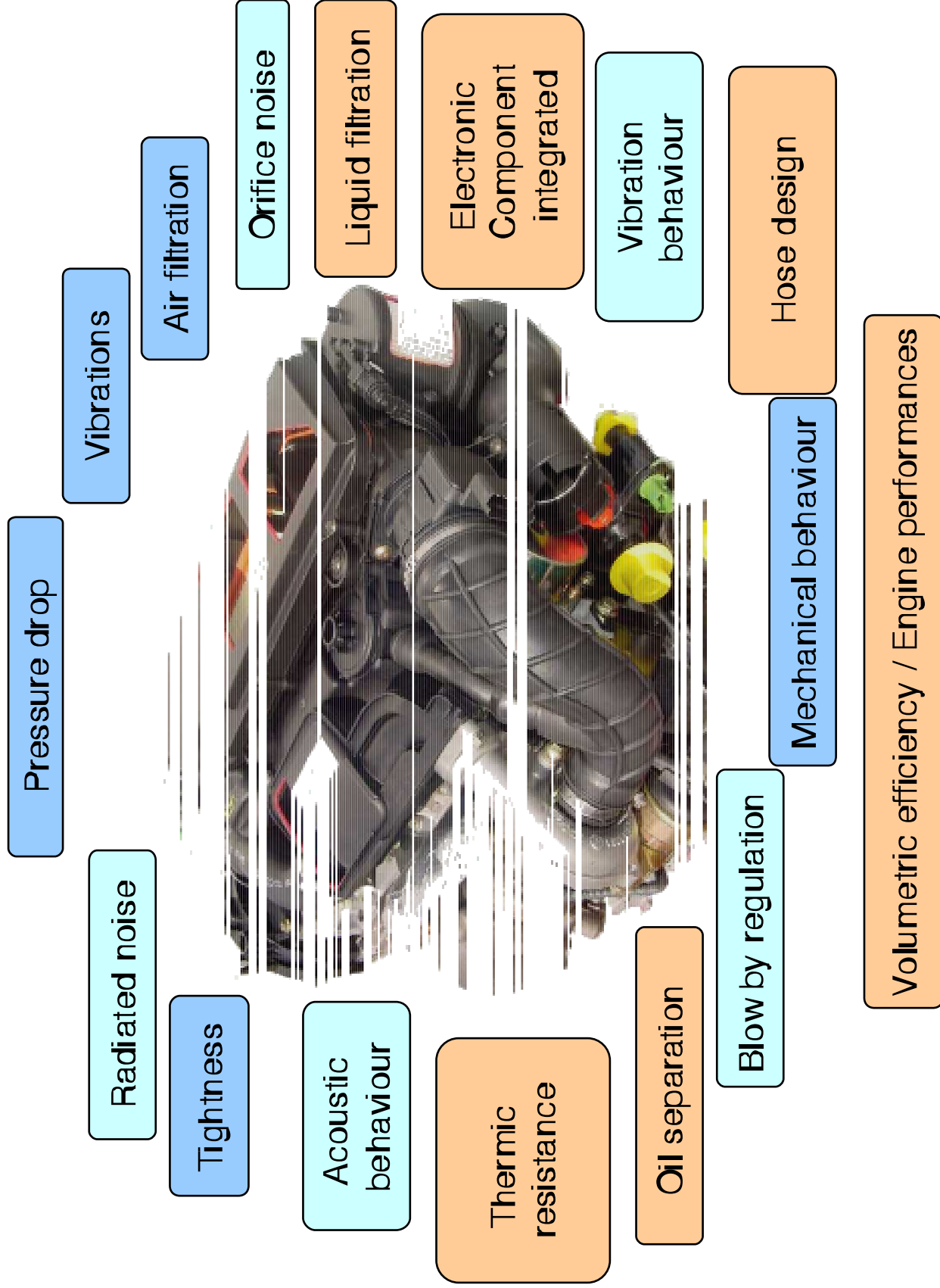
It is simple Just as Filter. But complex with surroundings



# REQUIREMENTS FOR AN AUTOMOTIVE AIR FILTER SYSTEM

CONFIDENTIEL

## Reliability - Safety



## Environnement

# KEY POINT FOR THE DEVELOPMENT OF A FILTER

CONFIDENTIEL

- Permeability (Pressure Drop)
- Filtration requirement ( capacity and efficiency)
- Space available around the engine
- Life time



- We use a special calculation to estimate the life time of a filter element.

## **Important Parameters to Consider :**

- - Dust Holding Capacity calculation with the surface of the filter element.
  - > Need experience and data base to co-relate with the past experience.
- Average speed of the vehicle
- The kind of engine (Petrol / diesel / ..)
- Concentration of dust and humidity in the atmosphere
- Air flow requirements

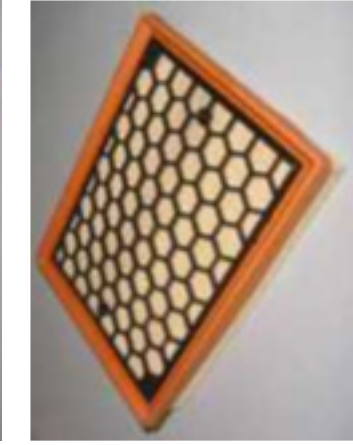




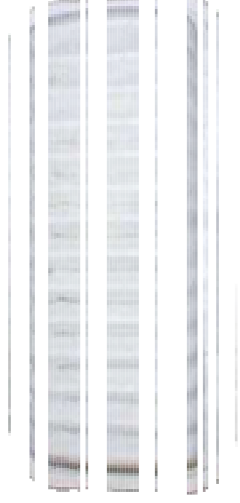
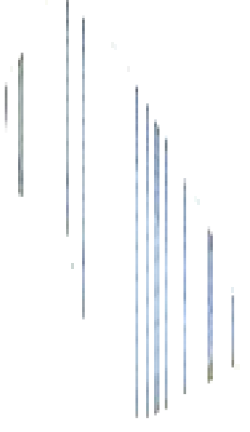
# FILTER ELEMENT

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## PAPER MEDIA

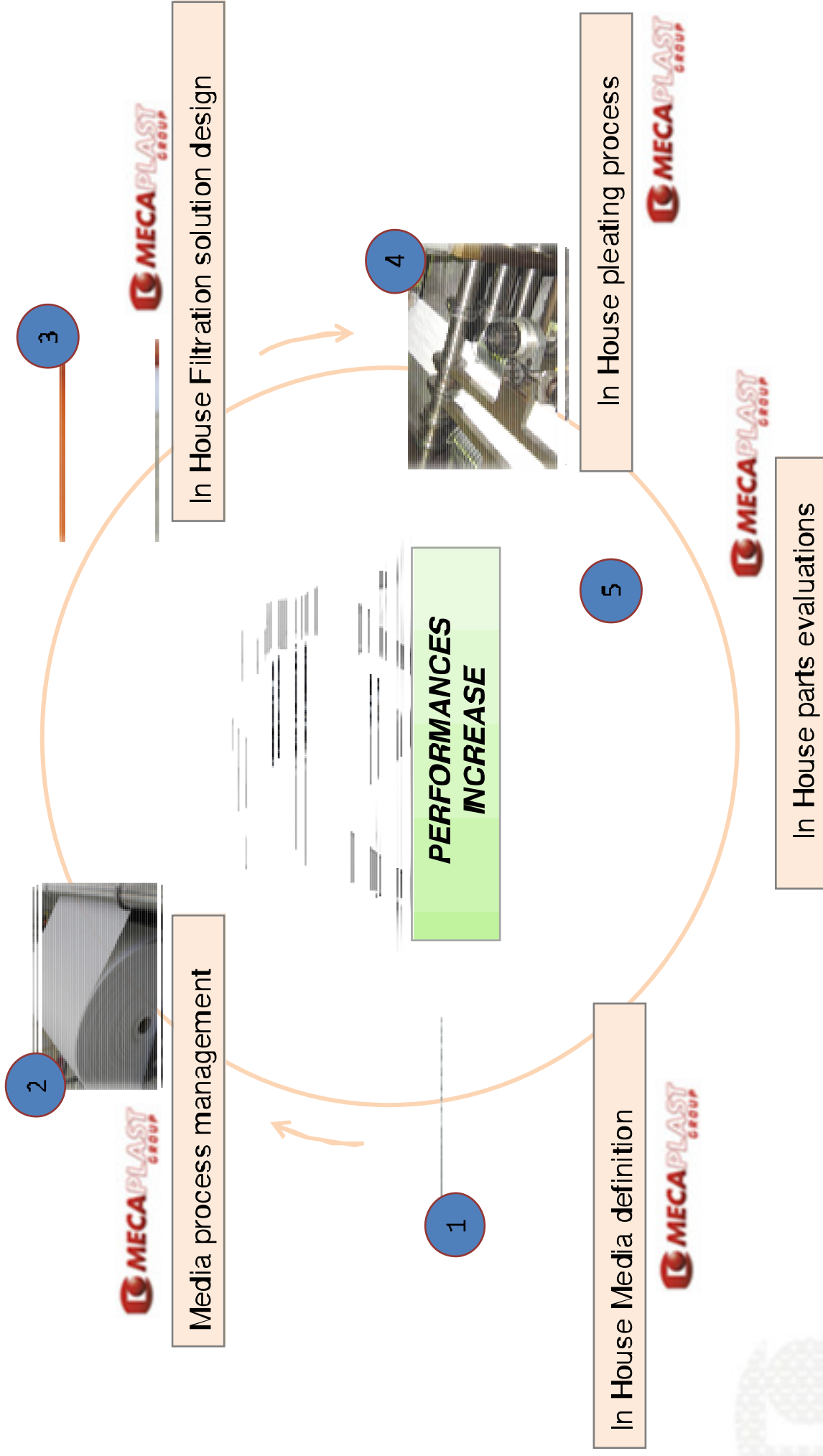


## NON WOVEN MEDIA



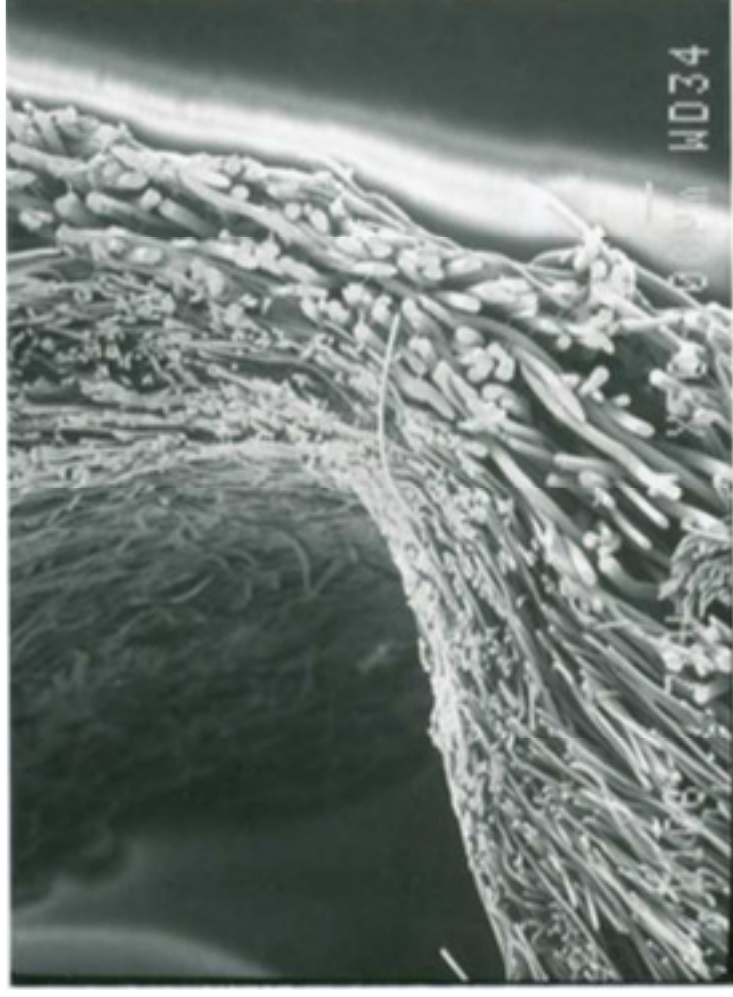
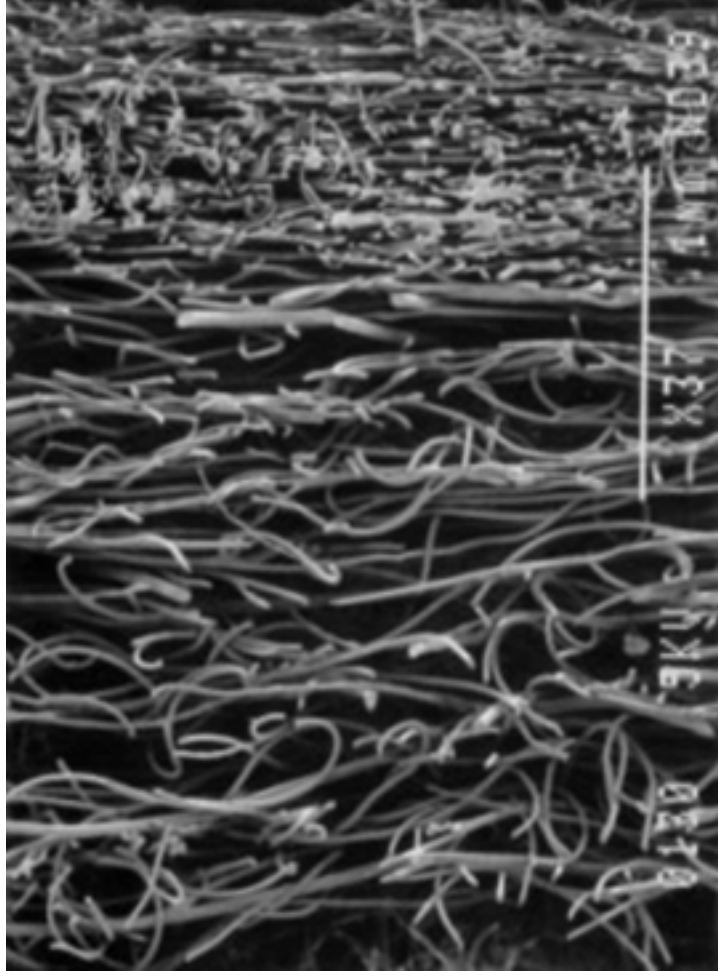
Integrated expertise

+ Mecaplast continuously improves its Media performances through its deep expertise



## IN HOUSE MEDIA DEFINITION

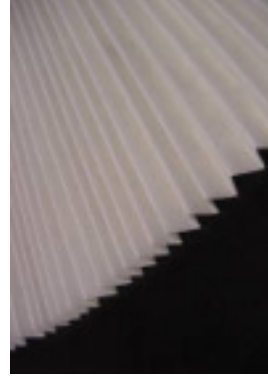
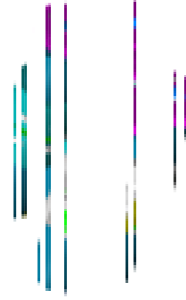
- + **MECAPLAST** designs in House its synthetic filtering media solutions.
- + We've developed our synthetic media for over 12 years, in order to provide our customer the best "air intake" solutions.



These solutions are **100% polyester** fibers contents, we also include in our layer recycled fibers.

IN HOUSE ENGINEERING AND PRODUCTION

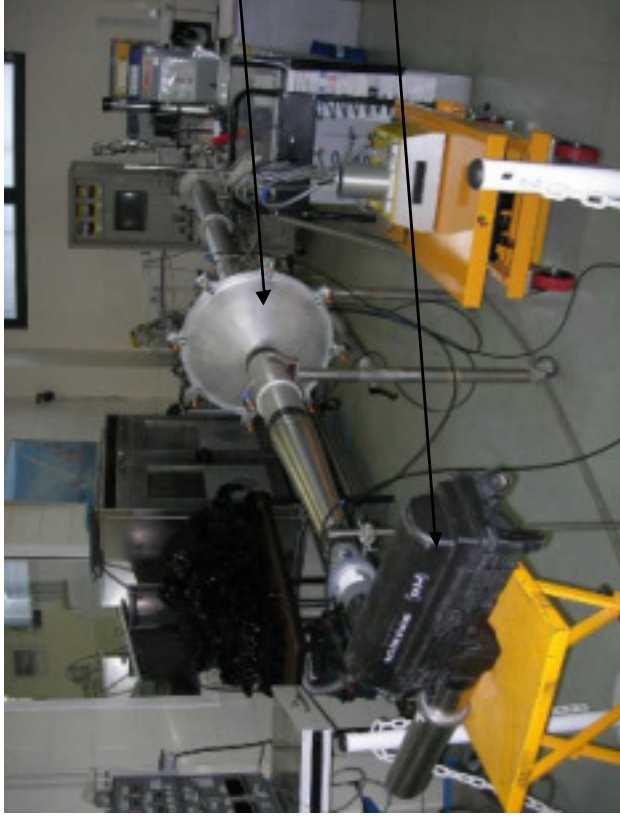
+ In House - pleating process & seal overmolding



The Mecaplast pleating technologies for synthetics media are **100% compatible with the Mecaplast pleating process, all over the world.**

# VALIDATION OF THE FILTER ELEMENT IN LABORATORY

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Aéraulic bench  
 Absolute Filter  
 Filter box

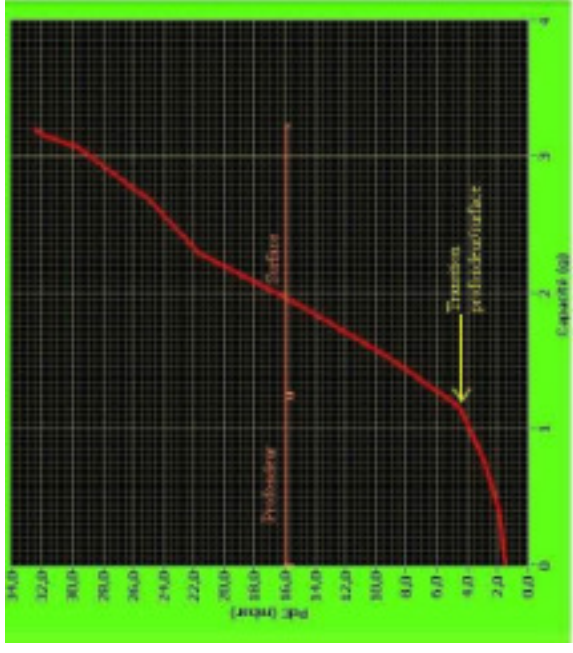
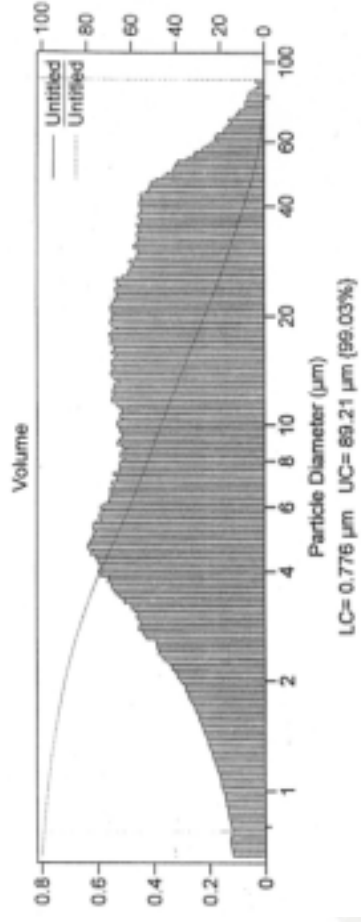
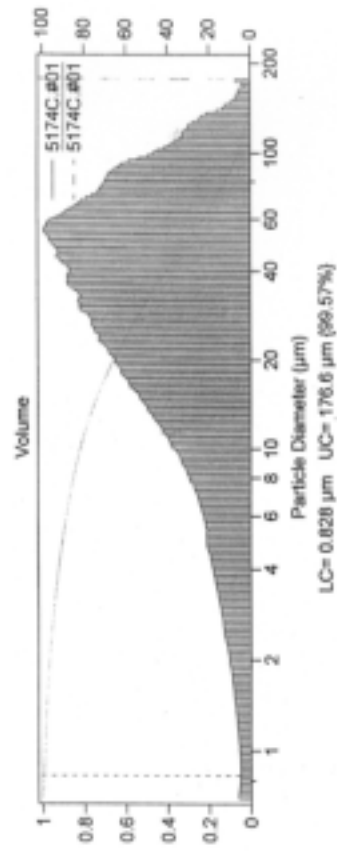


Diagramme capacité perte de charge



Fine Dust  
 Average diameter = 8,862  $\mu\text{m}$



Coarse Dust  
 Average size= 25,63  $\mu\text{m}$

# LABORATORY

## Technical centre of Lens in France : Validations

### ORGAN BENCH LAB

- Pressure Loss
- Initial Filter efficiency
- Final filter efficiency
- Filter capacity
- Static burst pressure
- Pressure pulsation
- Backfire
- Cold impact
- Shape stability
- Leakage
- Compression set
- Heat ageing



- Salt mist test
- Dust test
- Chemical resistance
- Water protection test
- Water tightness
- Cleanliness
- Orifice Noise
- Shell noise
- Vibration reduction
- Wall Stiffness
- Vibration durability test
- ...



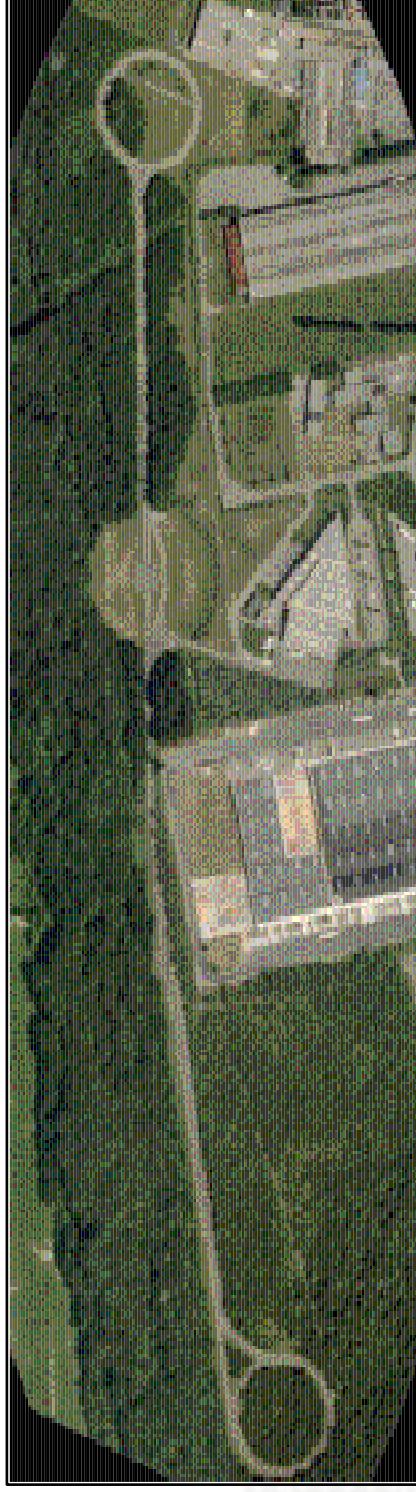
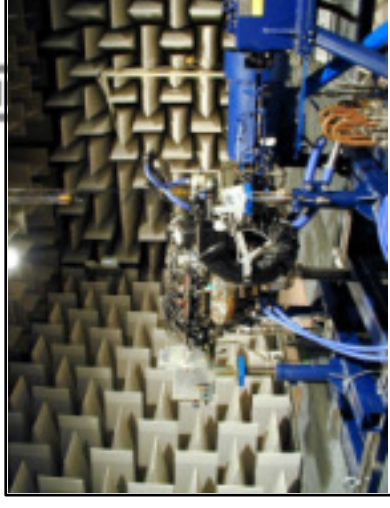
# ACOUSTIC VALIDATIONS

## Technical centre in France



### ACOUSTIC & ENGINE BENCH LAB

- 1 Full Anechoic Engine Bench
- 4 Engine Benches
- 1 Semi anechoic Chamber with roller bench
- 3 Reverberant rooms
- 1 track
- Holography equipment .....



Moisture resistance

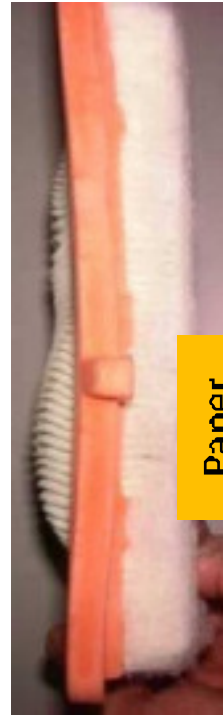
+ Resistance to water



Paper  
NOK

Paper  
NOK

Synthetic  
media  
OK



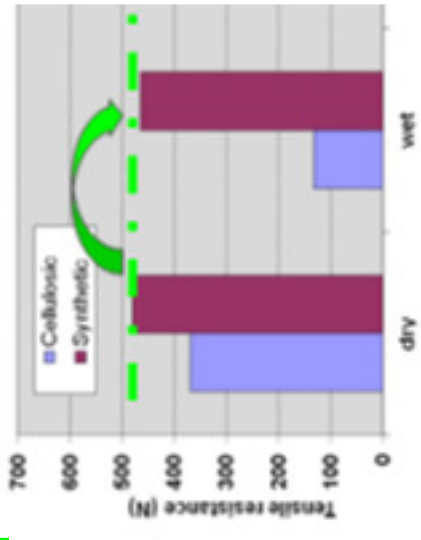
Paper  
NOK

Prototype  
part



Synthetic  
media  
OK

Prototype  
part

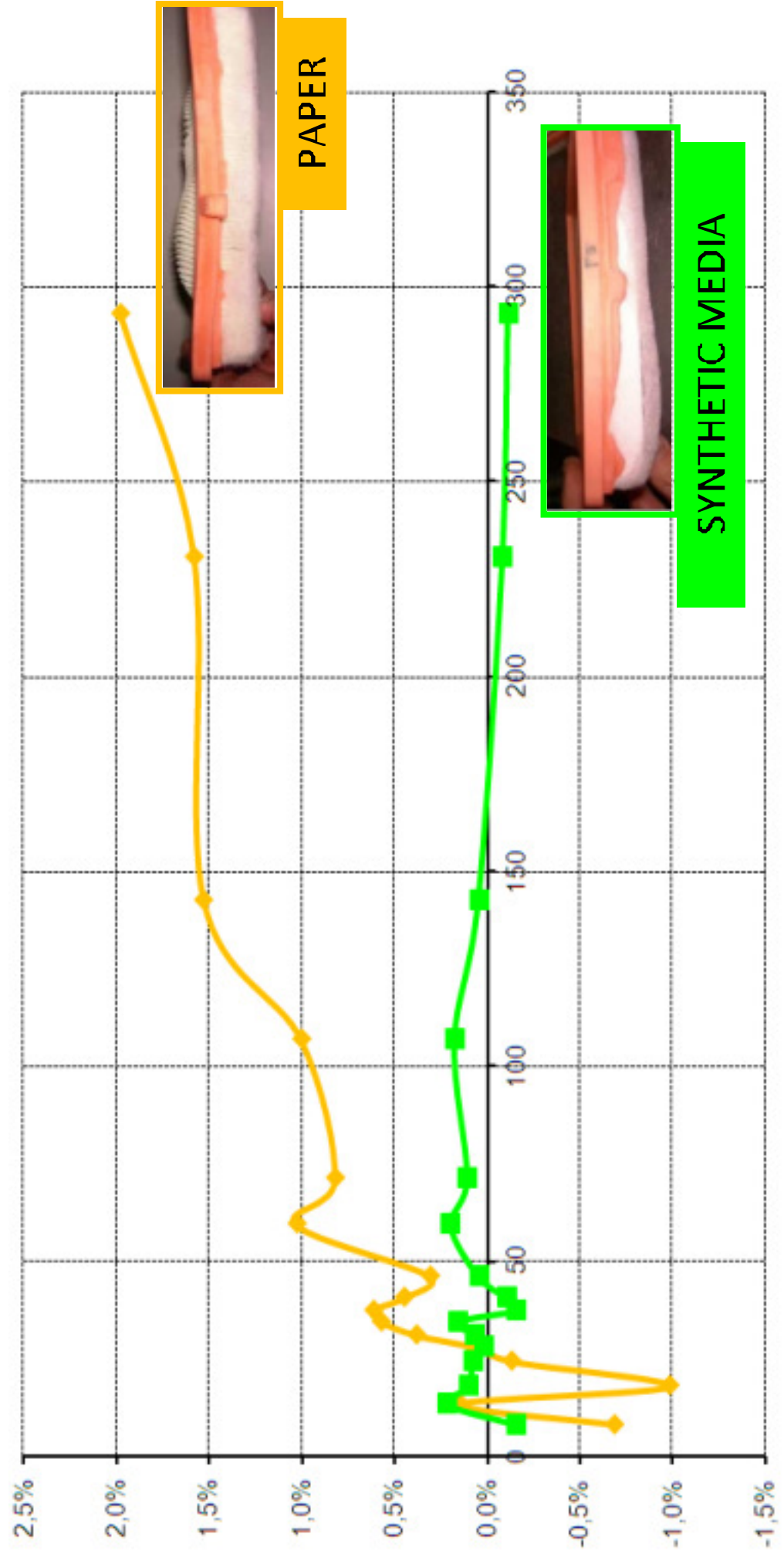


After wet strength test, the synthetic media holds the pleat structure. The Synthetic Media is more robust than paper under wet condition.



MOISTURE RESISTANCE

+ Example of air flow signal noise deviation : before & after wet test

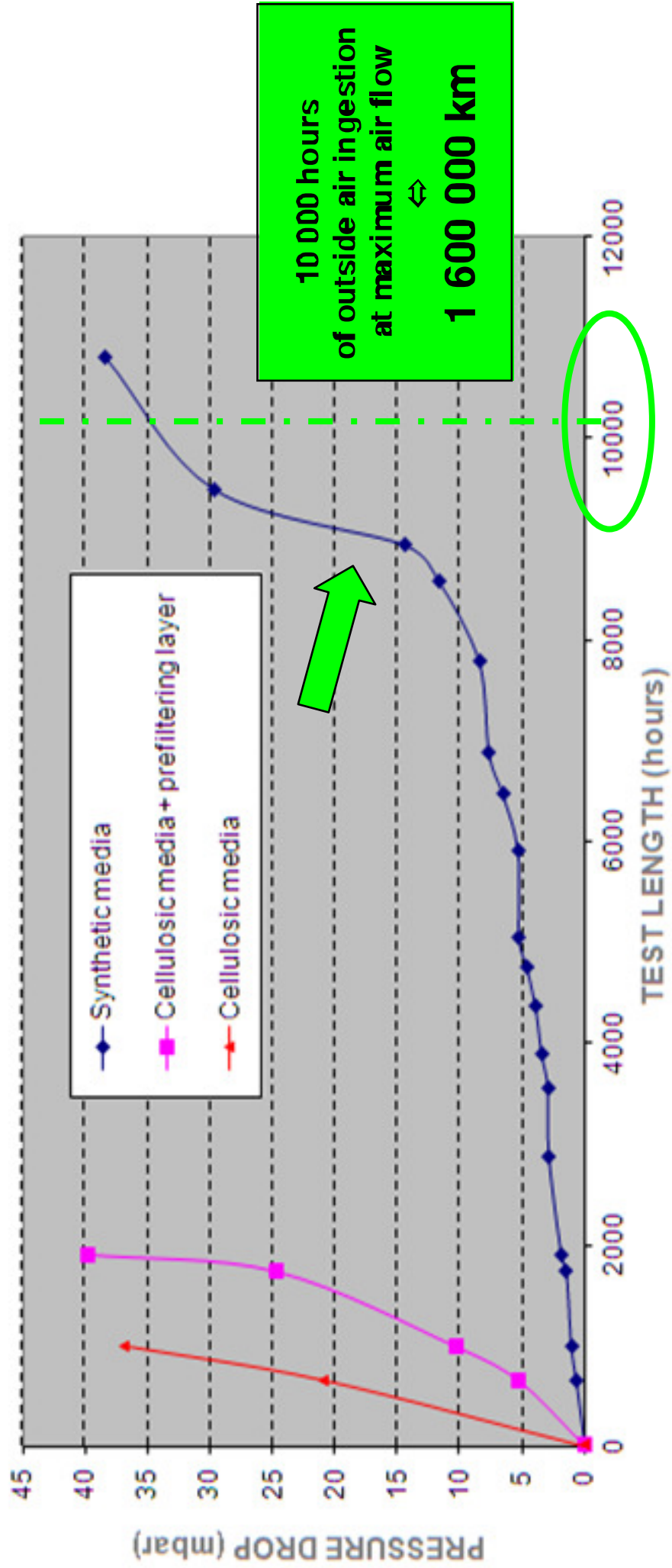


After wet test, no bad influence on the signal noise with the Synthetic Media.

OUTSIDE AIR ENDURANCE TEST

+ Results

Out door Air flow rate @ 299 kg/h



The max. pressure drop is reached 8 times later than the paper + fleece  
 The behaviour of the synthetic media is better in real conditions than paper

OUTSIDE AIR ENDURANCE TEST

+ Results



Paper  
after 1 000 hours



Paper + Non woven  
after 2 000 hours



Synthetic Media  
After 10 000 hours

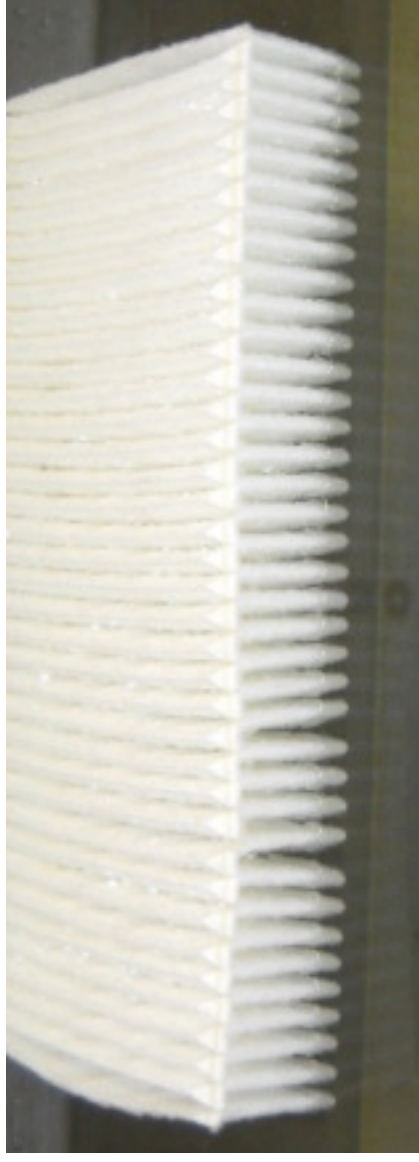
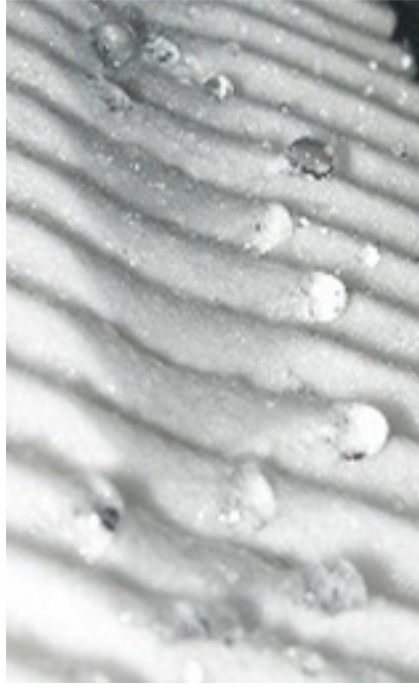


**No distortion of MECAPLAST synthetics media after 10 000 hours at max. flow rate, or 1 600 000 km at max. air flow rater**

**=> Good for AFM noise**

Robustness

+ **Hydrophobic properties available**



Mecaplast proposes a range of Synthetic Filtration Functions with hydrophobic properties.

The synthetic filter panel with hydrophobic treatment does not ingest water



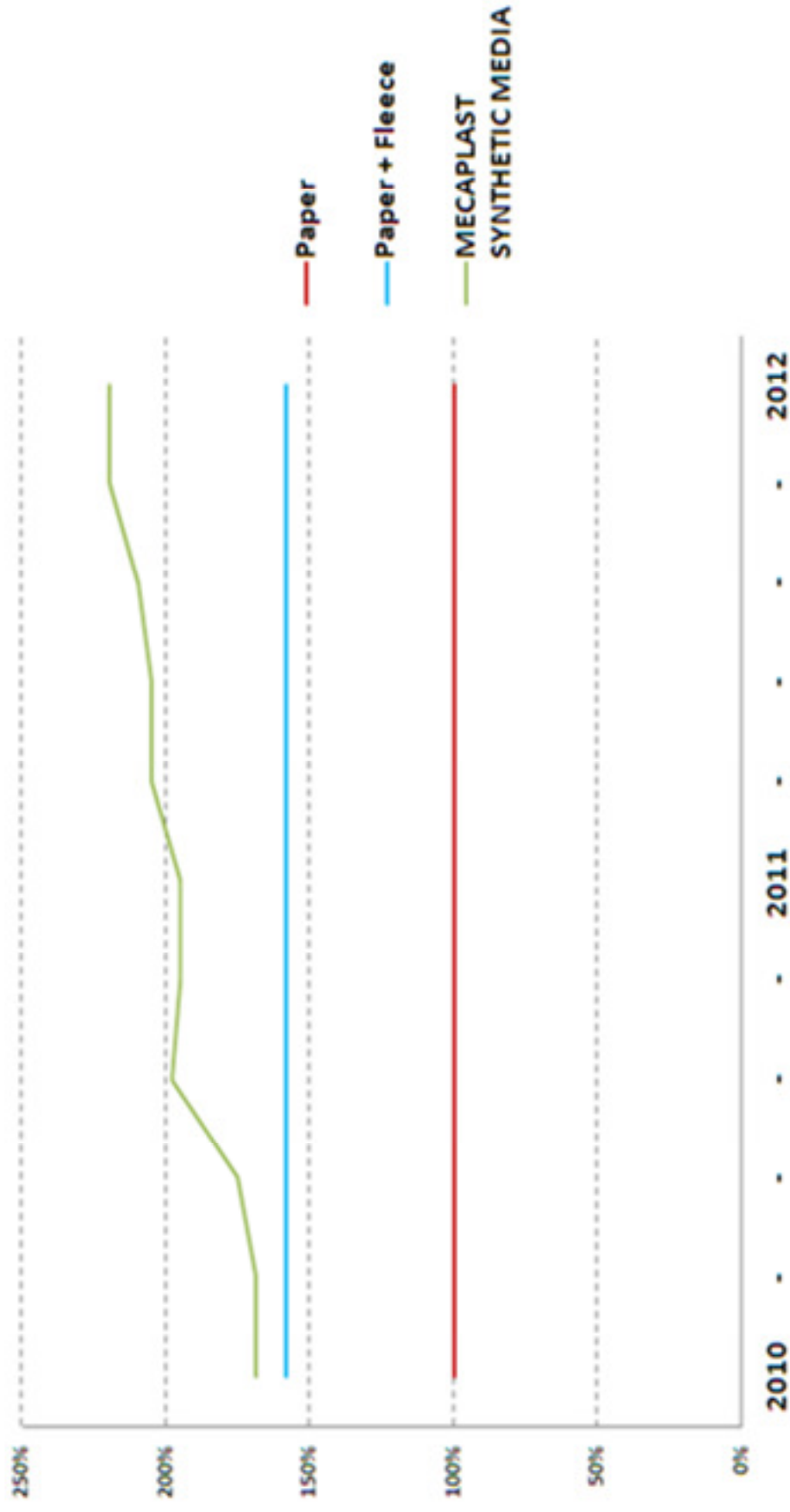
The hydrophobic properties is guaranteed on the entire Lifetime.

The Synthetic Media shows better performance than the paper / fleece

The Synthetic Media is a real water barrier.

Capacity performance vs Space & Weight

+ Mecaplast continuously improves the Media capacity



In fine dust, the Capacity of the Mecaplast synthetic Media is :

**120% higher than paper**

**60% higher than Paper+Fleece**

Capacity performance vs Space & Weight

+ Air Filter Box shape simplification : cost saving

Original concept

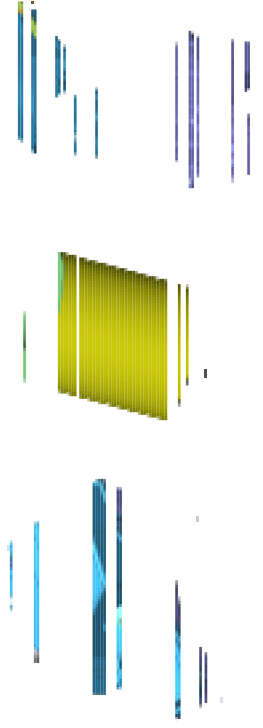
Paper

Air flow : around 1000 kg/h

Capacity : 90 000 km  
Efficiency > 99,5%

⇒ Surface : 1m<sup>2</sup>

⇒ Cylindrical filter element



Proposal

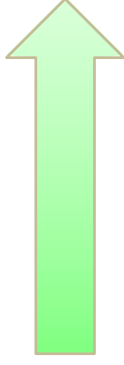
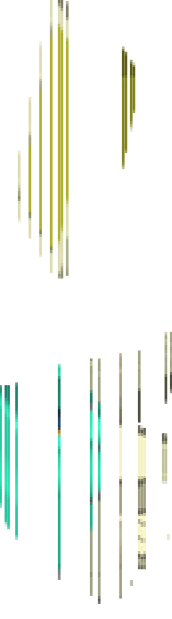
Synthetic Media

Air flow : around 1000 kg/h

Capacity : 90 000 km  
Efficiency > 99,5%

⇒ Surface: < 0,5m<sup>2</sup> only

⇒ flat filter element panel



The synthetic media higher capacity saves cost without decreasing the final performance.

# ANALYSE WITH MICROSCOPE

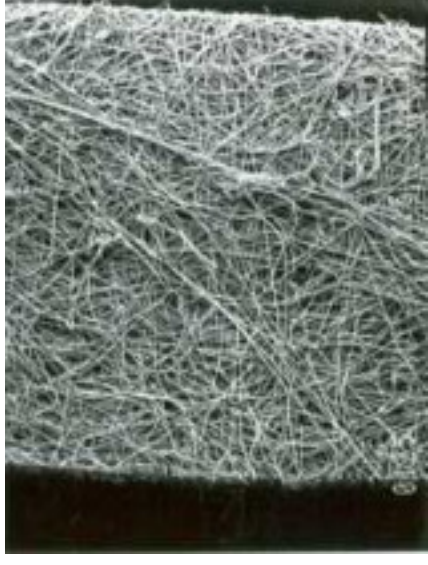
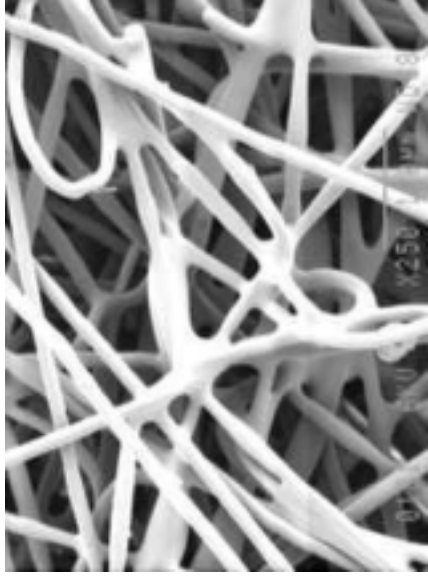
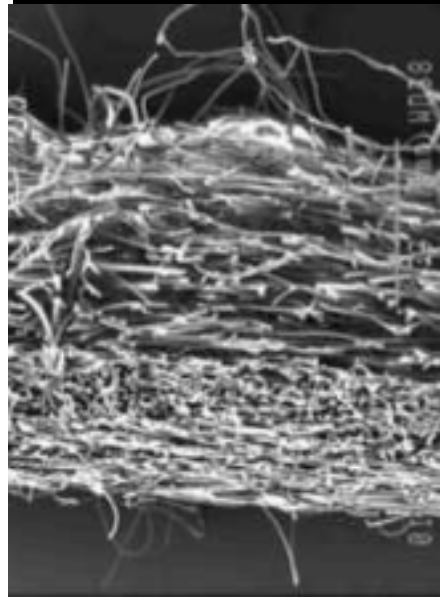
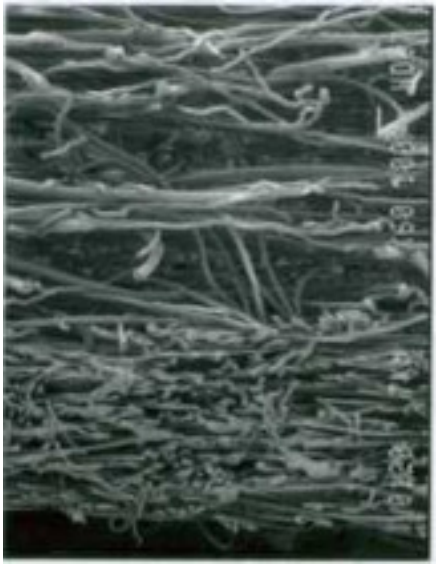
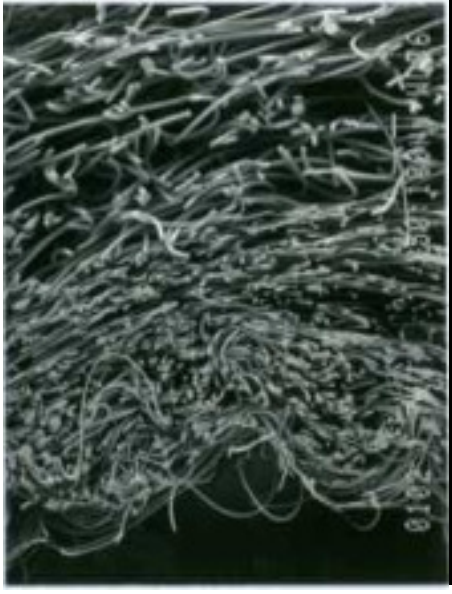
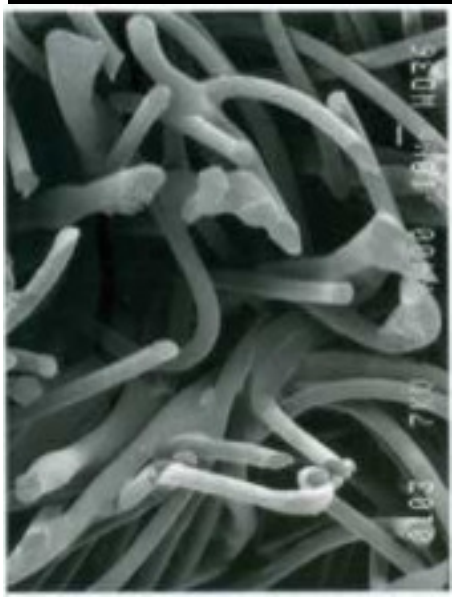
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In order to improve the dust holding capacity of our synthetic filtration media , we've started a study with Gemtex (french textile laboratory), to get a better understanding of the behaviour of the filtration layer during the clogging by dust.



# PICTURE OF SYNTEHTIC NON WOVEN MADE WITH MICROSCOPE

CONFIDENTIEL

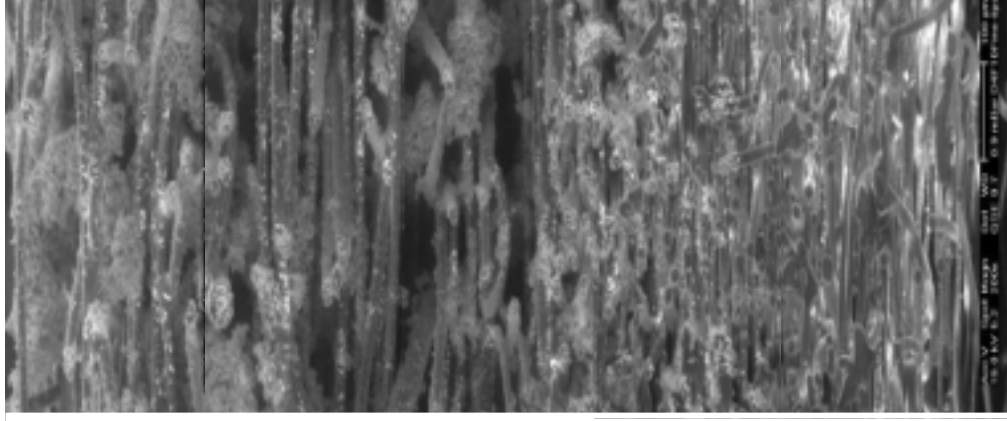




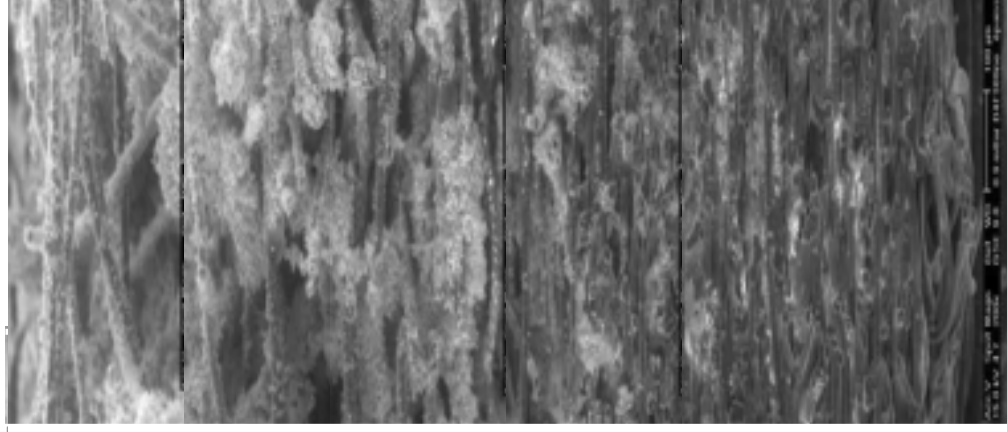
# PICTURE OF SYNTETIC MEDIA CLOGGED WITH DUST

CONFIDENTIEL

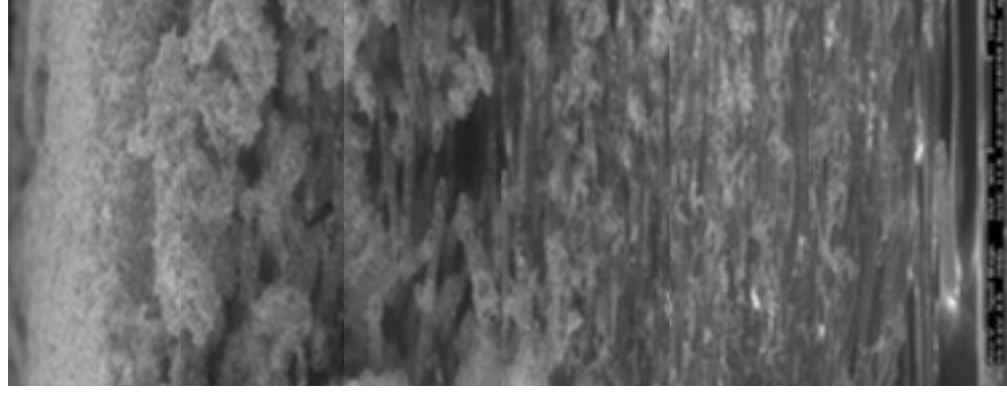
D4F Colmaté 11,6g



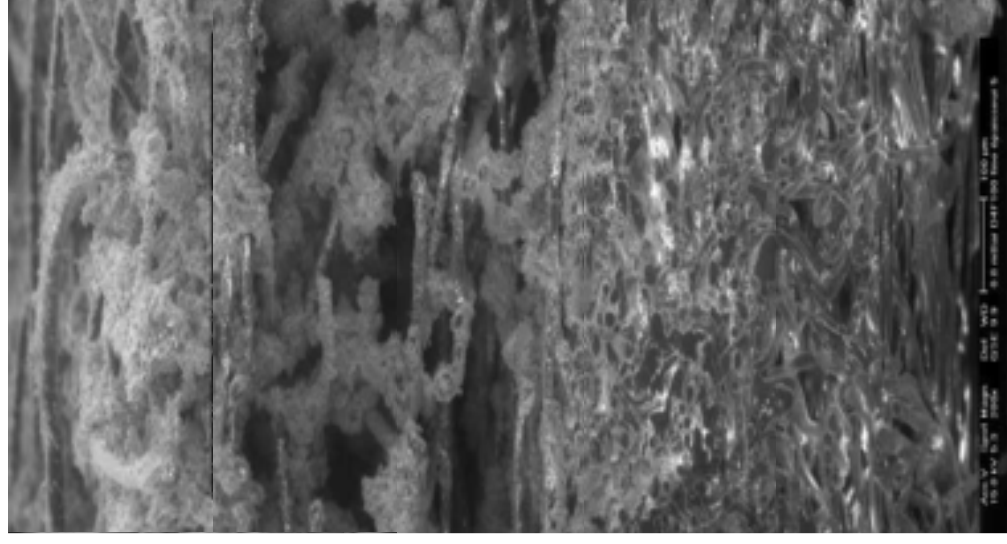
D4F Colmaté 27,70g



D4F Colmaté 64,20g

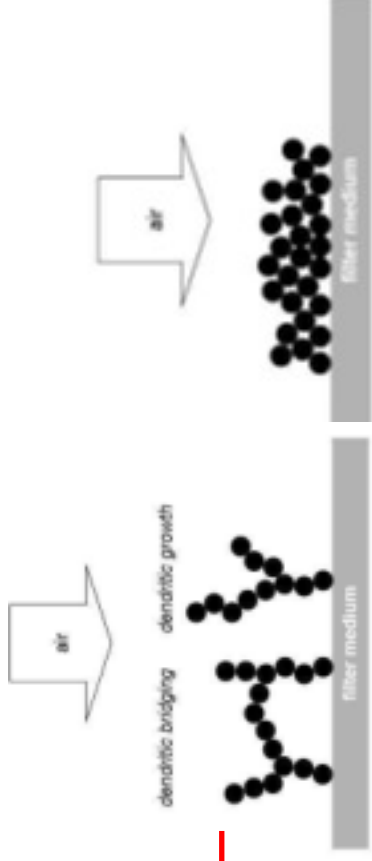
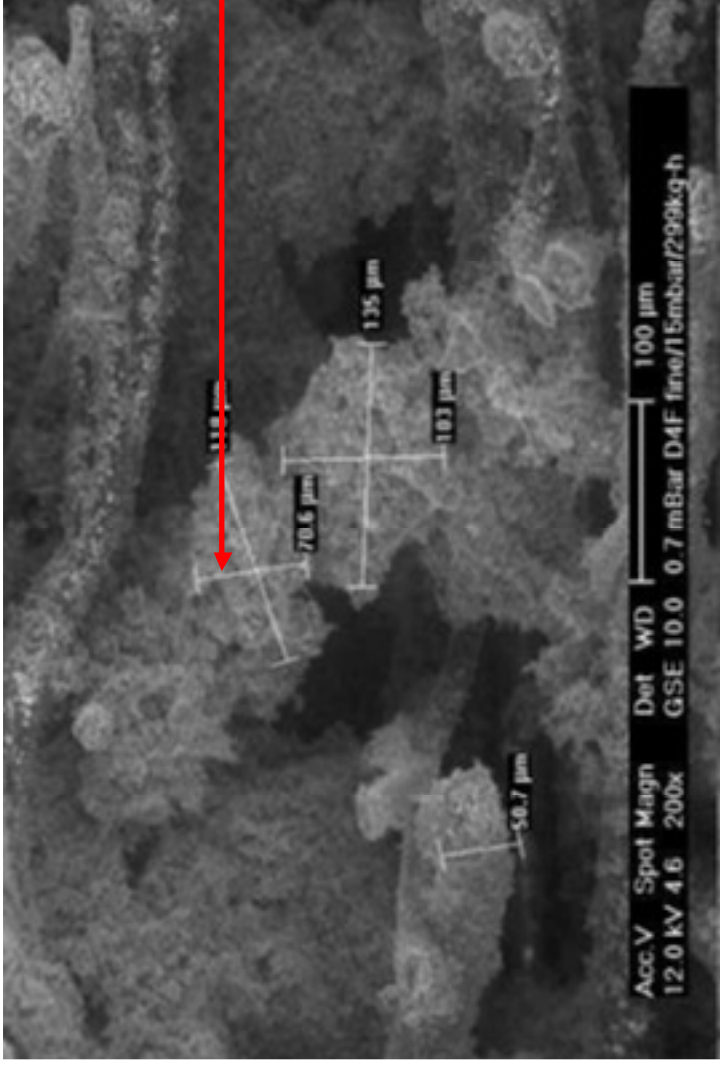


D4F Colmaté 111,70g



# PICTURE OF CLOGGING IN THE THICKNESS OF NON WOVEN

CONFIDENTIEL



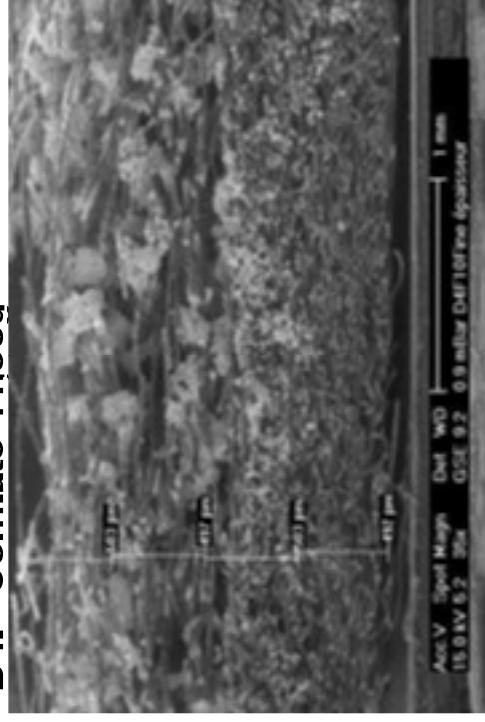
During the clogging in the thickness of the media the particulate of dust are catching by the fiber

- At the beginning, dust particles are accumulating on the top of the Filter media and forming a cake of dust. This cake of dust also increase the efficiency of filtration.
- Due to this Permiability will reduce and hence Pressure Drop will increase. We need to find a fine balance between efficiency and Pressure Drop while deciding the replacement frequency.

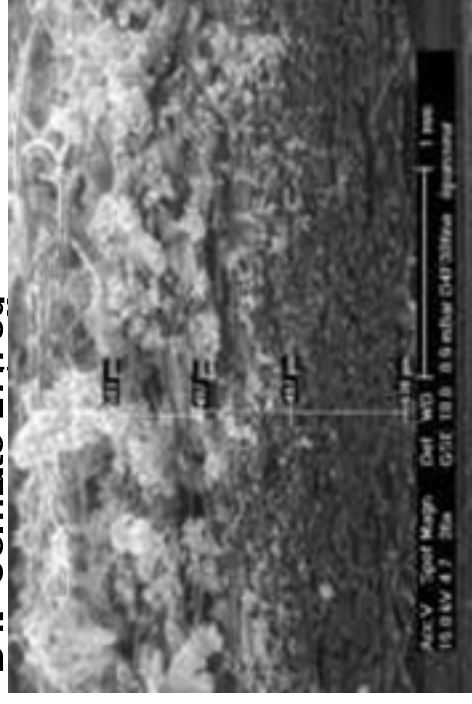
# PICTURE OF CLOGGING IN THE THICKNESS OF NON WOVEN

CONFIDENTIEL

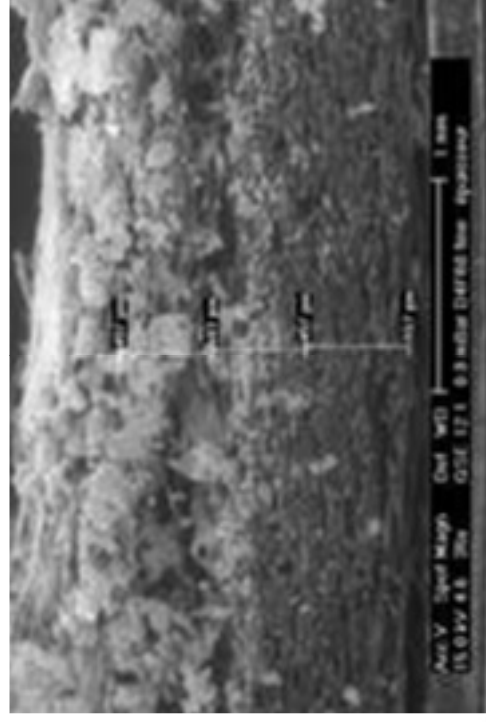
D4F Colmaté 11,60g



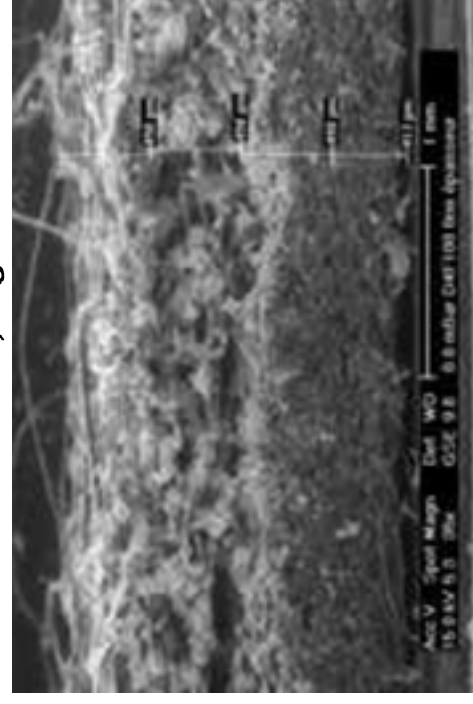
D4F Colmaté 27,70g



D4F Colmaté 64,20g



D4F Colmaté 111,70g

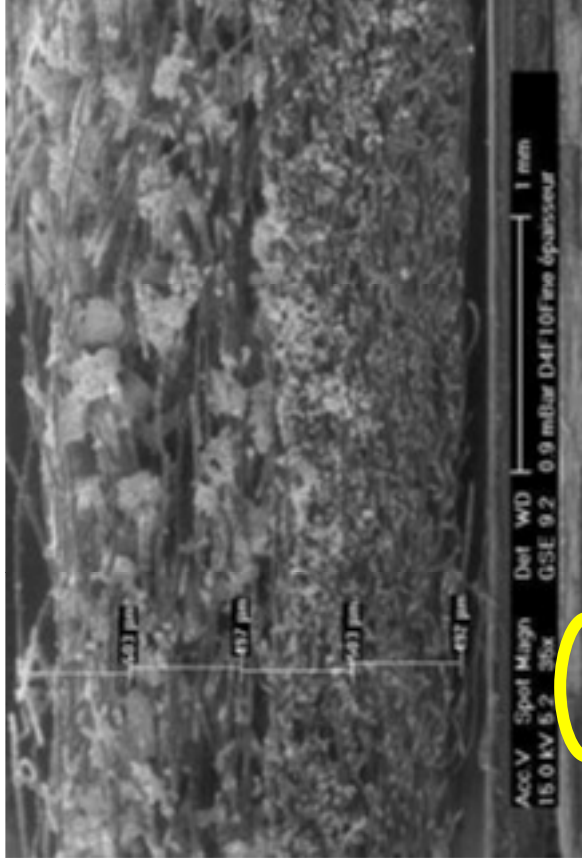


Particule size on the clean air side: 0,4µm à 2µm

Particule size on the dirty air side: 1µm à 6µm

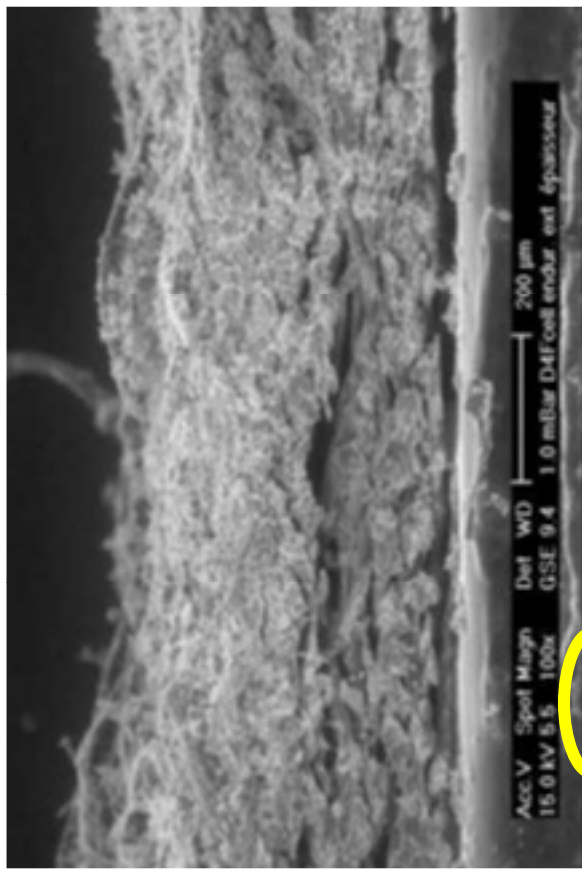
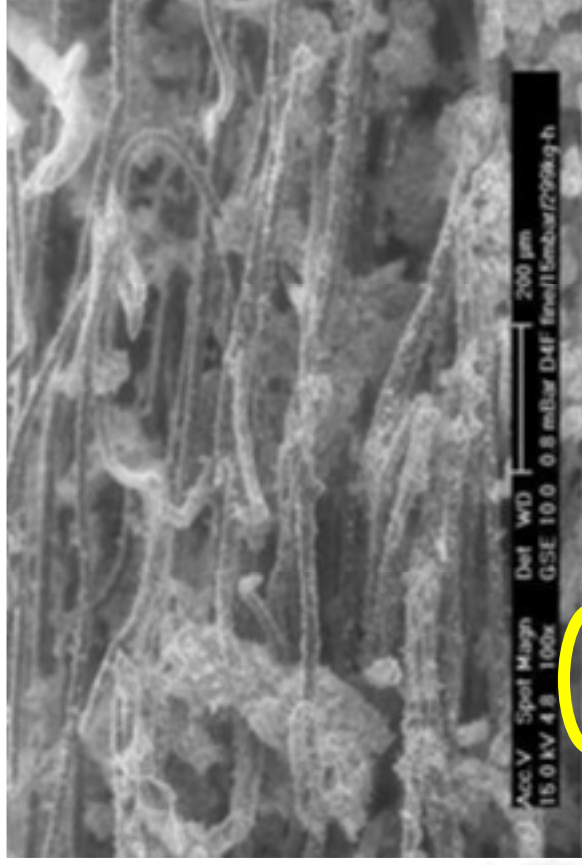
# DIFFERENCE BETWEEN THE CLOGGING OF A PAPER AND A NON WOVEN

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D4F synthetic

D4F Cellulose




## Conclusion



- **Higher Dust Holding Capacity +120% more than paper**
- **Better Spectral Efficiency For E>99%, particle size >2µm (paper 6µm)**
- **MAF sensor signal stability** during lifetime.
- **More Robust than paper :** Moisture condition : **Tensile resistance : + 30%**  
Road condition : **Lifetime 8 times longer than paper**
- **Real Barrier to water :** Hydrophobic Solution
- **Fire resistance :** **Self extinguishing FMVSS 302 / F1 & K1 (DIN 53438 part 3 & 1-2)**
- **100% In-house** development and manufacturing.

PERFORMANCE WRAP-UP v.s. PAPER

<u>criteria</u>	<u>Paper</u> 	<u>Paper + Fleece</u> 	<u>Synthetic Media</u> 
Dust hold Capacity	😊	😊😊	😊😊😊
Efficiency	😊😊	😊😊	😊😊
Robustness after aging test	😊	😊	😊😊😊
Pressure loss after aging test	😊😊	😊😊	😊😊
Water resistance	😊😊	😊😊	😊😊
Moisture resistance	😊	😊	😊😊😊
Water separation	😊	😊😊	😊😊
Weight	😊	😊	😊😊
Price	😊😊	😊	😊😊

**LONGER LIFETIME GUARANTY**

**BETTER ROBUSTNESS / DURABIUITY THAN PAPER**

INNOVATION

+ Next step : 100% Synthetic Solution – no PU gasket



**100% synthetic**

**100% recyclable**

**100% non-flammable**

**Weight reduction (-20%)**

**Cost reduction (-10%)**



# Thank you

